

2006 National Conference on Building Commissioning

Monitoring-Based Commissioning (MBCx)

**Early Results from a
Portfolio of University Campus Projects**

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19 April 2006

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UC/CSU/IOU Energy Efficiency Partnership Program

Funded by California Investor-Owned Utility Customers
under the auspices of the California Public Utilities Commission

University of California
California State University
Pacific Gas and Electric
Southern California Edison
San Diego Gas & Electric
Southern California Gas

2004-05: \$15 Million
Continuing in 2006-08

Targeted-Savings Elements
Retrofit
Monitoring-Based Commissioning (MBCx)

Information-Only Element
Training and Education (includes new construction)

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Monitoring-Based Commissioning (MBCx)
UC/CSU/IOU Energy Efficiency Partnership Program

Key Program Features

- Improved Operation of Existing Equipment/Systems**
(as opposed to retrofit equipment upgrades)
- Permanent Monitoring with Trending Capability**
identifies dysfunction
assures verification and persistence of savings
- Savings opportunities identified by combination of:**
monitoring
test protocol-based methods
- Benchmarking**
- Identification of Future Retrofit Projects**
- Best Practices Report for Future Planning**
- Training for Campus Staff**

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Brief History of Monitoring-Based Commissioning (MBCx)

1985-92	PG&E	Thermal Energy Storage & Load Profile Monitoring
1993	SMUD/PECI	1st National Conference on Building Cx
1994-99	California Utilities/CIEE	"Diagnostics for Cx & Operations"
	CEC/CIEE Texas A&M California Cx Collaborative	IMDS 160 Sansome Street IMDS 925 L Street ~ 100 Buildings
2000-03	SMUD/CIEE	IMDS 925 L Street Persistence of Retro-Cx
	PIER UC Santa Barbara CSU Long Beach Central Florida State University UC Merced	Planning and Design
2004-05	UC/CSU/IOU Partnership PIER	CSU/UC Campuses

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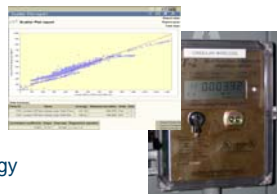
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**Monitoring-Based Commissioning (MBCx)
UC/CSU/IOU Energy Efficiency Partnership Program**

Funding for:

Permanent Monitoring

- Meters
- Telemetry
- Trending Software
- Whole-Building Energy Sub-System



Commissioning Consultants

- Emphasis on Training for Campus Staff

In-House Staff (Limits)

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**Monitoring-Based Commissioning (MBCx)
UC/CSU/IOU Energy Efficiency Partnership Program**

2004-05 Program Statistics (1 of 3):

- 25 Campuses
- 9 Plant System Projects
- 37 Building Projects
over 7 million gross square feet
~ half laboratory or other energy intensive buildings



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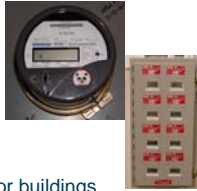
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**Monitoring-Based Commissioning (MBCx)
UC/CSU/IOU Energy Efficiency Partnership Program**

2004-05 Program Statistics (2 of 3):

\$5.2 Million Total Funding
Project Size \$20k - \$290k
\$0.21 - \$1.54 per gross square foot for buildings



**Monitoring-Based Commissioning (MBCx)
UC/CSU/IOU Energy Efficiency Partnership Program**

2004-05 Program Statistics (3 of 3):

Savings Targets (Conservative for Pilot Program)

Portfolio of Projects	Program Commitment
1.0 MW peak demand	0.9 MW peak demand
9,300,000 kWh per year	7,300,000 kWh per year
580,000 therms per year	300,000 therms per year

**Monitoring-Based Commissioning (MBCx)
UC/CSU/IOU Energy Efficiency Partnership Program**

2004-05 Partial Portfolio Reporting as of 31 March 2006:

- 14 Building projects completing initial commissioning
 - 4 Lab buildings with high fume hood density ("dense")
 - 3 Lab buildings with low fume hood density ("light")
 - 1 Lab building with TBD fume hood density
 - 6 Non-lab buildings (one with a data center)
- 1 Plant project completing initial commissioning
- 4 "Combined" projects including major retrofit component
- 2 "Truncated" projects not completing all low-cost Cx
- 2 Projects reporting estimated savings from planned Cx

UC/CSU/IOU Energy Efficiency Partnership Program

Monitoring-Based Commissioning (MBCx) Partner Team

Mark Bramfitt, Pacific Gas and Electric (PG&E, Co-chair)
Karl Brown, UCOP (Co-chair)
Maric Munn, UCOP
Ryan Stroup, PG&E (Lead for MBCx Training and Education)
Len Pettis & Aaron Klemm, CSU
Paul Kylo & Tony Pierce, Southern California Edison
Randall Higa, Southern California Gas
Guy Hansen, San Diego Gas and Electric
Keith Marchando, Sonoma State University
Jim Dewey, UC Santa Barbara

MBCx Team Consultants

Richard Sterrett, Alternative Energy Systems Consulting
Mike Anderson, Matt Sullivan & Andrew Meiman, Newcomb Anderson McCormick
Ziyad Awad, Awad & Company

**Monitoring-Based Commissioning (MBCx)
UC/CSU/IOU Energy Efficiency Partnership Program**

Support Organizations

Portland Energy Conservation, Inc (PECI)
Project Scoping Consultant to Campuses
MBCx Curriculum Development & Lead Instructor(s)

**California Energy Commission
Public Interest Energy Research (PIER) Program**
Technical Support (LBNL)
MBCx Case Studies and Needs Assessment
Monitoring (EIS) System Architecture
Benchmarking
MBCx Curriculum Development (PECI thru New Buildings Institute)

Commissioning Providers

**Monitoring-Based Commissioning (MBCx)
UC/CSU/IOU Energy Efficiency Partnership**

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Reference: Brown, K., and M. Anderson. 2006. "Monitoring-Based Commissioning: Early Results from a Portfolio of University Campus Projects." In *Proceedings of the 13th National Conference on Building Commissioning*. Portland, Ore.: PECE. Available at: <http://www.peci.org/ncbc/ncbc.htm>

Process Case Study from UC/CSU/IOU Partnership MBCx Program

Common Steps

- 1) Install / augment / calibrate monitoring
- 2) Verify historical energy use baseline

Site-Specific Steps

- 3) Monitor for two days in warm weather
- 4) Adjust controls to allow proper chilled water flow to coils
- 5) Observe fan speed reduction of 40%+

Common Steps

- 6) Document post-measure energy use
- 7) Continue trend evaluation to ensure persistence of savings

Process Case Study from UC/CSU/IOU Partnership MBCx Program

Common Steps

- 1) Install / augment / calibrate monitoring
 - Upgrade building power and gas meters
 - Add energy information system (EIS) front end for trending
- 2) Verify historical energy use baseline
 - with new building power and gas meters
 - and existing building chilled water meter

Process Case Study from UC/CSU/IOU Partnership MBCx Program

Site-Specific Steps

- 3) Monitor for two days in warm weather
 - Identify chilled water loop imbalance
- 4) Adjust controls to allow proper chilled water flow to coils
- 5) Observe fan speed reduction of 40%+
 - with peak demand reduction & net energy use reduction
 - including chiller plant

Could this measure have been identified by other means? **Probably**

Was it identified prior to the MBCx project? **No**

Process Case Study from UC/CSU/IOU Partnership MBCx Program

Common Steps

- 6) Document post-measure energy use
- 7) Continue trend evaluation to ensure persistence of savings
with changing building operation and use

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